

AMENDMENTS TO THE DRAWINGS

In amended FIGURE 1, a “Prior Art” legend has been added. As such, the applicant respectfully submits that drawings are now in compliance with 37 C.F.R. 1.121(d).

The attached drawing sheet includes changes to FIGURE 1. This sheet replaces the original sheet 1/4.

Attachment:            Replacement Sheet 1/4

REMARKS

**I. Status of the Application**

Claims 5-19 are pending in this application. In the May 4, 2007 Office action, the examiner objected to Figure 1 under 37 C.F.R. 1.121(d). The examiner rejected claims 5, 11-12, 14 and 16 under 35 U.S.C. § 103(a) as allegedly being obvious over U.S. Patent Publication No. 2002/0048924 to Lay et al. (“Lay”) in view of U.S. Patent Publication No. 2004/0087057 to Wang et al. (“Wang”). The examiner has also rejected claims 6-8 under 35 U.S.C. § 103(a) as allegedly being obvious over Lay in view of Wang and further in view of U.S. Patent No. 6,153,525 to Hendricks et al. (“Hendricks”). Claim 9 is rejected under 35 U.S.C. § 103(a) as allegedly being obvious over Lay, Wang and further in view of U.S. Patent No. 5,846,853 to Otsuki et al. (“Otsuki”). Claims 10 and 13 are rejected under 35 U.S.C. § 103(a) as allegedly being obvious over Lay in view of Wang and further in view of U.S. Patent No. 6,812,065 to Kitamura et al. (“Kitamura”). Claim 15 is rejected under 35 U.S.C. § 103(a) as allegedly being obvious over Lay, Wang and further in view of U.S. Patent No. 6,555,414 to Vanfleteren et al. (“Vanfleteren”). Claims 17 and 19 are rejected under 35 U.S.C. § 103(a) as allegedly being obvious over Lay, Wang, Hendricks and Otsuki. Claims 18 is rejected under 35 U.S.C. § 103(a) as allegedly being obvious over Lay, Wang, Hendricks, Otsuki and Kitamura.

In this response, applicants have amended claims 5, 12 and 17. As set forth below, applicants respectfully traverse the examiner’s rejection of claims 5-19.

**II. The Rejections Under 35 U.S.C. § 103(a) Should Be Withdrawn**

In the May 4, 2007 Office action, the examiner rejected claims 5-19 under 35 U.S.C. § 103(a) as allegedly being obvious and unpatentable over some combination of Lay, Wang, Hendricks, Otsuki, Kitamura and Vanfleteren. Applicants respectfully traverse the examiner's rejection of claims 5-19 under 35 U.S.C. § 103(a), as the examiner has not made a *prima facie* case of obviousness as described in MPEP § 2142 - 2143.

**A. Claims 5, 11-12, 14 and 16**

In order for the examiner to make a *prima facie* case of obviousness under MPEP § 2143.03, all claim limitations must be taught or suggested by the prior art. In addition, there must be some suggestion or motivation, either in the references or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Finally, there must be a reasonable expectation of success.

In the present case applicant respectfully submits that the examiner has not established a *prima facie* case of obviousness, as all limitations of independent claims 5 and 12 are not taught or suggested by the prior art. Furthermore, as set forth in the paragraphs below, there is no suggestion or motivation to combine the references, and there is no reasonable expectation of success.

Examples of different limitations from claims 5 and 12 missing from the cited prior art are set forth in the paragraphs below along with additional arguments related to the need for a *prima facie* case of obviousness.

*1. attaching a flip-chip to a substrate*

On page 3 of the May 4, 2007 Office action, the examiner cites Lay as teaching a method of attaching a flip-chip to a substrate. However, Lay does not teach attaching a flip-chip to a substrate. Instead at [0004] Lay relates to “attachment of a bared die to a glass panel called (COG: chip on glass)”. Wang is a different configuration where the contacts are soldered together rather than the chip being attached to the substrate. Accordingly, all claim limitations are not taught or suggested by Lay and Wang, and the examiner’s rejection of claims 5 and 12 under 35 U.S.C. § 103(a) should be withdrawn for at least this reason.

*2. an insulating layer on the lateral sides of the first plurality of electrical contacts*

Lay does not teach a first plurality of contacts on a flip-chip. The examiner considers (at paragraph 13 page 5 of the May 4, 2007 Office Action) that Lay discloses forming a lateral insulating layer of silicon oxide on the first plurality of contacts. The applicant respectfully disagrees. Lay at [0024] refers to a completed configuration as shown in Figure 3. The metal bump 42 of Lay is taught at [0002] as a separate component; not part of the chip 34 or the substrate 30, nor would one of ordinary skill in the art consider the metal bumps 42 to be equivalent to a first plurality of contacts (which are included with the flip-chip) as specified in claims 5 and 12. Accordingly, all claim limitations are not taught or suggested by Lay and Wang, and the examiner’s rejection of claims 5 and 12 under 35 U.S.C. § 103(a) should be withdrawn for at least this reason.

3. *an insulating layer on the lateral sides of the second plurality of electrical contacts*

The examiner admits (at paragraph 6 page 3 of the May 4, 2007 Office Action) that Lay does not teach a lateral insulating layer on the second plurality of electrical contacts. The examiner then contends that Wang at [0033] teaches a lateral insulating layer on the second plurality of electrical contacts. The applicant respectfully disagrees. Wang at [0033] teaches a solder mask 4a located between the bonding pads 7.

Applicants note that because the contacts in Wang are soldered together, the solder mask is provided for physical protection of the substrate. There is no disclosure of this layer being electrically insulating. Should the examiner maintain the rejection for any reason, the examiner should show where in Wang the solder mask is described as being electrically insulating.

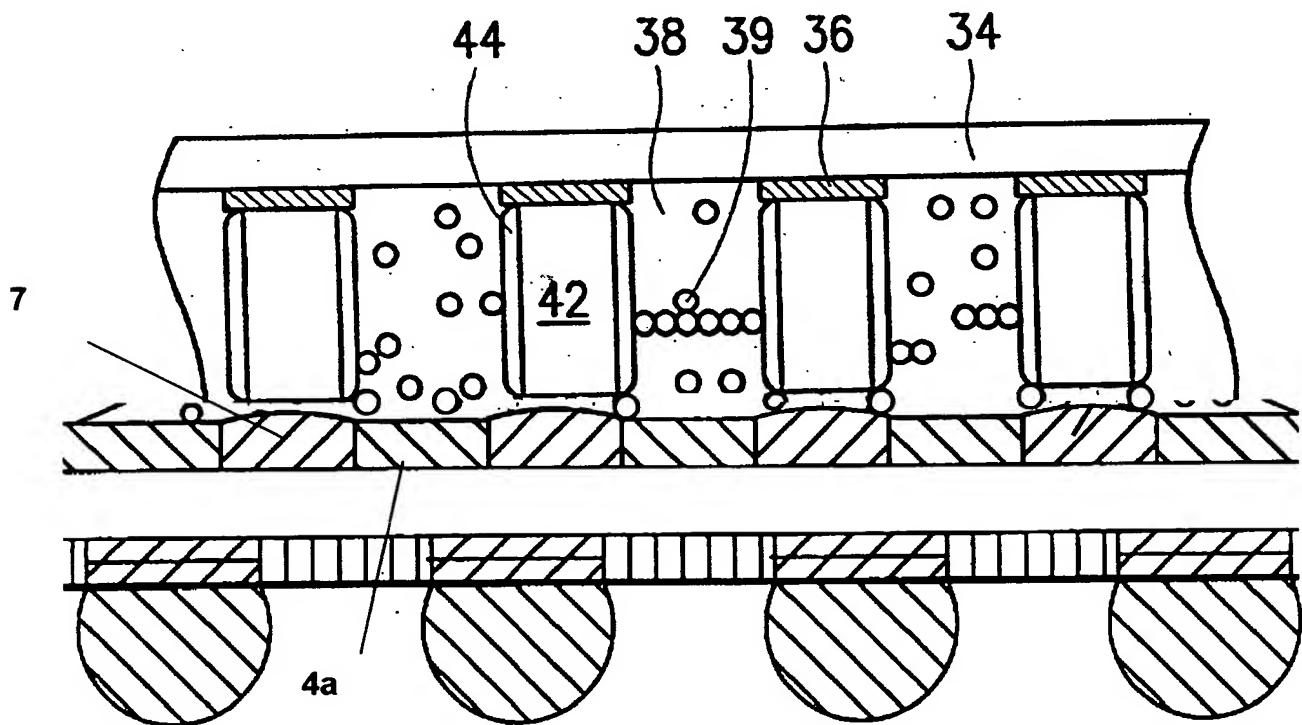
In addition to the above, the solder mask 4a in Wang is not formed on the lateral sides of a contact pursuant to the limitations of claim 5. Instead, the solder mask 4a of Wang is formed on the non-conductive base layer 8. This is evident, for example, from paragraph [0033] of Wang which states that the bonding pad 7 protrudes above the solder mask 4a. Thus, the solder mask 4a may likely be formed before the bonding pad 7.

Applicant finds no teaching in Wang to suggest otherwise. In view of the foregoing, Wang can be considered to teach formation of a solder mask 4a on the non-conductive base layer 8. It cannot be considered to teach formation of the solder mask on the lateral sides of the bonding pad 7, as set forth in claim 5.

Accordingly, as set forth above, all claim limitations are not taught or suggested by Lay and Wang, and the examiner's rejection of claims 5 and 12 under 35 U.S.C. § 103(a) should be withdrawn.

*4. joining the flip-chip to the substrate to electrically connect the contacts*

With respect to the limitation of "joining the flip-chip to the substrate using a matrix of insulating material ... to electrically connect the first plurality of contacts with the second plurality of contacts", the applicant presumes that the alleged combination of Lay and Wang as proposed by the examiner would be as set forth in the following diagram:



In the foregoing diagram, the top portion of the diagram is taken from Lay (FIG. 3B) and is related to those portions of Lay cited by the examiner in the May 4, 2007 office action.

The bottom portion of the diagram is taken from Wang (FIG. 1b) and is related to those portions of Wang cited by the examiner in the May 4, 2007 office action. The applicant disagrees that such an alleged combination teaches all of the required limitations of claims 5 and 12 as required by MPEP § 2143.01. In addition, applicant does not find any suggestion for a reasonable expectation of success with the alleged combination, as the alleged combination would be invalid and “unpredictable”. See MPEP § 2143.02. Furthermore, there is no motivation or teaching in the art to combine Lay and Wang.

Firstly, all claim limitations are not disclosed in Lay or Wang. Lay provides a solution to lateral shorting for a COG (not flip-chips) configuration. Wang relates to soldering the contacts. Therefore neither configuration teaches or relates to the configuration of joining a flip chip to a substrate in claims 5 and 12.

Secondly, there are several reasons why the alleged combination shown above wouldn't be considered valid or predictable by one of ordinary skill in the art. For example, the alleged combination shown above would not serve the purpose suggested by the examiner and moreover it might increase the chance of the package failing due to inadequate electrical connection. As shown above, in the best case scenario, there would only be a tiny contact point if any at the apex of each bonding pads 7. This would drastically raise the resistance and in most cases there would be no connection at all. Also, the conductive particles 25 would always rest on the solder mask 4a and not the bonding pads 7. If instead of the bonding pads 7 from Wang, the alleged combination utilized the first bonding pad 32 from Lay the risk of faulty connection would be increased further. For example if the metal bumps 42 weren't perfectly laterally aligned with the first bonding pads 32, a conductive particle 25 could contact with the solder

mask 4a instead of the first bonding pad 32 thereby preventing a connection. In either case there is a significant chance of the conductive particle 25 resting on the solder mask 4a and preventing a connection. Accordingly, there is no reasonable expectation of success with the alleged combination of Lay and Wang, and for at least this reason the examiner's rejection of claims 5 and 12 should be withdrawn.

Third, applicant submits that there is no reason why a person skilled in the art would seek to modify Lay using the teachings of Wang or combine Lay with Wang as at the date of invention. The examiner considers (See paragraph 6 page 3 of the May 4, 2007 Office Action) that, "It is obvious to one having ordinary skill in the art at the time the invention was made to modify the invention of Lay et al. with forming an insulating layer on the lateral sides of the bonding pads so as to prevent short circuiting between bonding pads". The applicant respectfully disagrees. One having ordinary skill in the art would use the common general knowledge to assume that in Lay the problem of lateral shorting was solved and would not seek to refer to further references. Clearly one of ordinary skill in the art would not appreciate any further risk of lateral shorting exists in the configuration taught in Lay. Even if this were not the case, Wang would not be considered by a person skilled in the art in any event since it does not disclose a lateral insulating layer or anything else relevant to the above purpose alleged by the examiner.

In view of the foregoing, it is respectfully submitted that all limitations of claims 5 and 12 are not found in the cited references. Moreover, there is no reasonable expectation of success with the suggested combination of Lay and Wang, and the examiner has not provided sufficient evidence of a motivation to combine the references. Therefore, it is respectfully submitted that the examiner has not made a *prima facie* case

of obviousness, and the examiner's rejection of claims 5 and 12 under 35 U.S.C. § 103(a) should be withdrawn.

B. **Claim 17**

In the May 4, 2007 Office action, the examiner rejected claim 17 under 35 U.S.C. § 103(a) as allegedly being obvious and unpatentable over Lay in view of Wang, Hendricks and Otsuki.

Claim 17 incorporates similar limitations to claims 5 and 12. As set forth above, the examiner's rejection of claims 5 and 12 should be withdrawn. Therefore, for at least the same reasons as claims 5 and 12, the examiner's rejection of independent claim 17 should also be withdrawn.

In addition to claims 5 and 12, claim 17 relates to the synergistic advantages to using a polishing technique to form a lateral insulating layer on the flip-chip contacts and an irradiation technique to form a lateral insulating layer on the substrate contacts.

Neither Lay, Wang, Hendricks nor any valid combination thereof teach using a polishing technique to form a lateral insulating layer on a set of flip-chip contacts. In the May 4, 2007 Office action, the examiner cites column 3, lines 15-24 of Hendricks as disclosing this limitation. However, column 3 lines 15-24 of Hendricks only disclosing the polishing of a dielectric film to planarize the film. Hendricks does not teach removal of an overlying portion from a set of contacts. Furthermore, Hendricks does not disclose a set of flip-chip contacts with a lateral insulating layer on the contacts nor removing the portions overlying the contact by polishing.

Similarly Neither Lay, Wang, Otsuki nor any valid combination thereof teach using an irradiation technique to form a lateral insulating layer on a set substrate contacts. In the May 4, 2007 office action, the examiner cited column 5, lines 23-31, 50-53 as disclosing this limitation. However, this cited portion of Otsuki does not teach any use of an irradiation technique in relation to layers on a substrate contact. Moreover, column 5 lines 23-31, 50-53 Otsuki does not teach at least a set of substrate contacts, forming a lateral insulating layer on the contacts, curing portions which do not overlie the contact nor removing the uncured portions to expose the contact.

As set forth above, none of the references cited by the examiner, either alone or in combination, teach the use of irradiation on the flip-chip contacts or using polishing on the substrate contacts. Accordingly, all of the limitations of claim 17 are not taught by the cited references, and the examiner's rejection of claim 17 under 35 U.S.C. § 103(a) should be withdrawn for at least this reason.

Moreover to validly combine four separate unrelated documents would require an overwhelming overriding motivation that applies to all of the documents. The examiner states the purposes as "to level the topography", "to prevent short circuiting" and "to accurately deposit and selective remove parts of a thin film" (see paragraphs 27-29 pages 10-11 of the May 4, 2007 office action). The first and third purposes are clearly unrelated and would not motivate one of ordinary skill in the art. The second purpose seems superfluous, since Lay has already taught a seemingly complete solution to this problem.

In view of the foregoing, it is respectfully submitted that the examiner has not made a *prima facie* case of obviousness, and the examiner's rejection of claim 17 under 35 U.S.C. § 103(a) should be withdrawn.

C. **Claims 6-11, 13-16 and 18-19**

In the May 4, 2007 Office action, the examiner rejected dependent claims 6-11, 13-16, and 18-19 under 35 U.S.C. § 103(a) as allegedly being obvious and unpatentable over Lay in view of Wang and further in view of some combination of Hendricks, Otsuki, Kitamura, and/or Vanfleteren. Each of these claims depends from and incorporates all of the limitations of one of independent claims 5, 12 or 17. As set forth above, the examiner's rejection of claims 5, 12 and 17 should be withdrawn. Therefore, for at least the same reasons as claims 5, 12 and 17, the examiner's rejection of these dependent claims should also be withdrawn.

Additional reasons also exist for the allowance of these dependant claims. For example, like claims 5, 12, and 17, all claim limitations are not taught by the combination of Lay, Wang, Hendricks, Otsuki and Kitamura. In addition, there is no basis in the art for combining the references. Furthermore, there is no reasonable expectation of success.

A particular example of additional reasons for allowance of the dependent claims can be seen with respect to claim 18. In rejecting claim 18, the examiner has relied on a combination of five distinct references to arrive at the rejection under 35 U.S.C. § 103(a). With respect to this rejection, the examiner simply concluded on page 12 of the office action that it would have been obvious to modify Lay in view of Wang as taught by Kitamura. The excessive number of references required to arrive at the examiner's

rejection suggests that it would not have been obvious to modify Lay and Wang as suggested by the examiner, or all of the limitations would have been provided in fewer references. In addition, while the examiner has stated a motivation for combining individual references in different locations, he has not stated a motivation for combining all of the references together. Accordingly, the examiner has not made a prima facie case of obviousness, and the examiner's rejection of claim 18 should be withdrawn for at least these reasons.

**III. Conclusion**

For all of the foregoing reasons, it is respectfully submitted that applicants have made a patentable contribution to the art. Favorable reconsideration and allowance of this application, including claims 5-19, is therefore respectfully requested.

In the event applicant has inadvertently overlooked the need for an extension of time or payment of an additional fee, the applicant conditionally petitions therefore, and authorizes any fee deficiency to be charged to deposit account 13-0014.

Respectfully submitted,



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